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Helen Cripps

Edith Cowan University, h.cripps@ecu.edu.au

Craig Standing

Edith Cowan University, c.standing@ecu.edu.au

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The Implementation of Electronic Health Records *Initial Findings from Ngaanyatjarra Lands*

Helen Cripps

Edith Cowan University, Australia
h.cripps@ecu.edu.au

Craig Standing

Edith Cowan University, Australia
c.standing@ecu.edu.au

Abstract

Information and communication technologies (ICT) are now part of the fabric of the global economy, however the adoption of ICT in the health sector has been significantly slower. The traditional drivers of adoption in the business sector are not always present in the health sector and there are a number of systemic inhibitors that make the adoption of ICT far more complex. This paper examines strategies that can be used to manage these complexities using a case study of a successful implementation of electronic health records in remote Western Australia. The desire for improved health outcomes by those involved overcame bureaucratic, technical and cultural barriers to the effective ICT adoption and use.

Keywords: e-health, remote regions, e-commerce, ICT

1 Introduction

Information and Communication Technology (ICT) has become ubiquitous in the globalised economy, however the adoption of ICT in the health field has been somewhat slower. The term used for the application of ICT in the health sector is Electronic-health (e-health), which is defined as “the adoption and adaptation of e-commerce technologies throughout the healthcare industry” (Wickramasinghe, Fadlalla, Geisler & Schaffer 2005, p. 318). The World Health Organisation (2009) defines e-health as the use of digital data that is transmitted, stored and retrieved electronically for the support of health care, both locally or remotely. According to the WHO (2009), e-health covers a range of technological areas and applications that electronically support the ordering of tests and medications, the making of clinical decisions, the reporting of results, the communication of key health information, and the digital storage of images, pictures and text.

This paper aims to investigate the drivers and barriers to e-commerce adoption in the health sector. A case study of the development of electronic health records in remote Western Australia is used to identify and highlight the drivers and barriers to e-commerce adoption in the health sector. The implications for digital records adoption in the healthcare sector are then discussed.

2 E-Health Adoption

In contrast to the rise of e-commerce, e-health is one area of e-commerce that has yet to reach its potential (Wickramasinghe, Fadlalla, Geisler & Schaffer, 2005). The adoption of e-health has been slow and problematic despite the development of various models of adoption in the health sector (Mantzana, Themistocleous, Irani and Morabito, 2007).

A number of issues have been identified both by academics and policy makers in relation to the adoption of e-health including; multiple stakeholders, a lack of a standard ICT platforms, security concerns with the storage and use of electronic patient information, and the role of government and the private sector in the adoption process.

2.1 Diversity of stakeholders

The diversity of stakeholders in the e-health system is often far greater than in the business e-commerce sector. This was highlighted by a recent report by the California Health and Human Services Agency (2009) that identified a stakeholder list of health care providers and consumers including; Physicians, Hospitals, Clinics, Telemedicine Providers, Facilities, Long term Care / Skilled Nursing, Public Health Departments, Emergency Rooms, Laboratories, Pharmacies, Home bound Patients, Payers (health funds), Consumers, Schools, Regional, Community & Childcare Centres. This diversity is also apparent in the Australian health system, which has both a public and private health system running in tandem supposedly providing the same services. Within the private system there is the presence of the both providers and insurance health funds that are not directly under the control of the government making uniform adoption difficult.

The multiplicity of stakeholders in health care makes adoption very erratic with some aspects of the health sector strongly adopting e-health and others resisting adoption. This is evidenced in Australia with around 90% of GPs now using computerised clinical packages. While prescribing is the most commonly used electronic function (98% of those who use a clinical package), medication safety functions, such as checking drug-drug interactions, are also frequently used. GPs also reported widespread use of electronic health record functions, including ordering laboratory tests (85%), updating allergy information (84%), and generating health summaries (84%) (McInnes, Saltman & Kidd, 2006). By comparison a multi national analysis of e-health research found that the level of adoption varied by country and also by health service i.e. the use of electronic health records was more widely spread in ambulance services than in the hospital environment (Jha, Doolan, Grandt, Scott & Bates, 2008).

An analysis of the successful adoption of national electronic health record programs from England, Germany, Canada, Denmark and Australia found the following critical areas: (a) acceptance and change management, (b) demonstration of benefits and funding, (c) project management, (d) Health-policy-related goals and implementation strategy, (e) basic legal requirements, particularly in the field of data protection. It was found that the strategic, organizational and human challenges are usually more difficult

to master than technical aspects (Deutscha, Duftschmid, & Dorda, 2010). The more centralised health systems in European countries, such as Denmark and England have a far higher level of adoption than those in Australia and the USA.

2.2 Cost of implementation

Though e-health is mooted to reduce cost associated with health service delivery (Dearne, 2009) the cost of implementation including infrastructure, equipment, training programs, and the change management needed to introduce new business practices is high. For Australia, the cost to implement an e-health system is 1.6 billion Australian Dollars over the next four years (Dearne, 2010a). For regional and remote areas of Australia the issues relating to infrastructure and cost are magnified (Rao, 2009). It is suggested that governments may need to provide some financial incentives to facilitate adoption of e-health (National Health and Hospitals Reform Commission, 2009).

Along with cost of infrastructure provision there are added complexities due to multiple software platforms being driven by private vendors. A review of research concerning electronic health records found one of the major issues was the proliferation of electronic health records formats and systems that have arisen due to the wide ranging needs and requirements of health care professionals and consumers. An additional challenge is to incorporate the international terminologies in order to achieve semantic interoperability across borders. (Hayrinen, Saranto & Nykanen, 2008). In Australia, there seems to be a divide between the government's implementation process and the software vendors who are going to have to make it work. According to the Medical Software Industry Association the vendor community has not been briefed on e-health despite the expectation that the vendors will be integral to the new system (Dearne, 2010b).

2.3 Privacy and security

The issue of privacy and security seems to be of greater issue in the USA and Australia. In the context of e-health in the USA it has been suggested that adoption of e-health will only be successful if health care providers and the government can assure the privacy and security of electronic data (HISPC, 2007). In Australia currently, there is ongoing debate in the media over privacy and security with the introduction of individual health identifiers. According to privacy experts these healthcare identifiers are seen as de facto national identity numbers and concerns over patient privacy and the protection of sensitive medical information in electronic systems are yet to be addressed (Dearne, 2009). On the other hand the government believes that electronic health records would enable people to take a more active role in managing their health and making informed decisions (National Health and Hospitals Reform Commission, 2009).

3 Case Study on the adoption of electronic health records

To further investigate the issues surrounding the adoption of e-health, a case was undertaken of Ngaanyatjarra (Ng) Health Service. The Health service is controlled by the Ngaanyatjarra Council which is made up of indigenous elders. The Council receives funding from State and Federal government agencies. The Council then contracts the provision of health care services out to a private provider who delivers health services to the indigenous people of the Ngaanyatjarra Lands. There are around 1,500 patients on the system but this depends as to who is on the Ngaanyatjarra Lands at the time. The clients are very mobile and even move across state borders accessing services in other

health systems. The Ngaanyatjarra Lands are located in the Western Desert region of outback Western Australia, some 1,000 kms from Alice Springs and 1,500 kms from Perth, making it one of the most remote locations in Australia.

The case study was chosen as it was an example of the successful use of electronic health records across a health network. It may seem ironic that e-health systems are being adopted in the most remote and disadvantaged regions of Australia rather than in the metropolitan areas. The data collection involved interviews of typically 50 minutes to one hour duration with the CEO, 13 clinicians and 4 IT staff in field trips out to the Ngaanyatjarra Lands, and staff at the Ng Health service's administrative centre in Alice Springs. The exploratory interviews included questions on the characteristics of the health information system, the barriers that had to be overcome, the benefits of the system and the continuing issues related to the system. The selection of participants was guided by their knowledge and use of the system (table 1). Four IT staff were interviewed because of their knowledge of the problems faced by users. This information was then compared with existing secondary data in the form of government reports and previous research into indigenous health.

Table 1: Details of Interviews

Interview	Interview Participants
1	IT Manager and 2 technical support officers and CEO of Ng Health
2	2 Clinic Nurses
3	Child Health Nurse
4	Pharmacist
5	3 Clinical Nurses and clinic receptionist
6	2 Cares and a nurse at an Ng Age Care facility
7	2 Clinic Nurses and a Chronic Disease Nurse
8	Chief Information Office for Ng Health
9	Follow up interview with IT Manager
10	Follow up interview with CIO

The interviews were recorded, transcribed and analysed for major themes that related to the drivers, perceived benefits, the inhibitors and risks associated with the adoption of digital patient records. Our objective was to understand the features of the health records system and to identify to what extent barriers, including long term organisational problems, were overcome in adopting and using the system.

The decision to implement electronic health records for the Ng Health Service was driven in part by increasing government regulation that meant the use of IT became essential to provide the detailed reporting required to secure funding from the relevant government agencies. Another factor has been the move towards electronic results from radiologists and pathologists which also creates further demand on e-records. The Ngaanyatjarra Health Service implemented an electronic health record system using a thin client, as this was the only software option at the time of implementation in 2005.

The remoteness of the region and extreme weather conditions lead to enormous technical difficulties with infrastructure, hardware and software.

3.1 Findings from the case study

From the data collected the drivers, inhibitors and risks were identified in relation to the adoption of electronic health records by the Ng Health service. A summary of the responses from the research are summarised in Table 2. The drivers could be grouped under health care and administrative benefits. From the respondents in the research there was an overwhelming sense that the record system provides more consistent and individualised health care and this would have long term benefits for their indigenous clients.

The adoption of electronic health records provided the ability to access a patient's records at whichever community health clinic they attended. The Ngaanyatjarra people are very mobile often travelling to other communities for extended periods of time to visit relatives or attend to family matters, such as a funeral. One of the nurses at a small clinic observed that *"basically I can see a patient at the clinic in the morning and they can presented at a clinic in 200kms away that afternoon"*.

In the past the nurse would have to ring the clinic in the home community of the patient to get relevant documents faxed or read out over the phone. The electronic records have made this practice virtually obsolete. The computer system reduced the error rate associated with nurses providing information over the telephone. This improved communication also extended to the Royal Flying Doctor Service who would be sent all the necessary information in digital format when their services were needed. *"When a patient has to be evacuated, the Royal Flying Doctor will get all of the information"* sent to the base. When the patient is loaded on the plane *"a paper summary is handed over and there is phone handover as well"* according to a clinic nurse interviewed.

Importantly, the access to common digital records provides for continuity of prescriptions since it is made clear what has been prescribed and when. The records also allow proactive health care in the form of running reports for patient recalls, immunisation or for specialists' visits.

As the health service is funded by State and Federal government departments the burden of record keeping and reporting to multiple agencies is significant. The electronic health records have improved the quality and consistency of the level of reporting, while reducing the cost and time required to produce the reports.

The introduction of electronic health records with their specific formats has created some subtle obstacles as the electronic health records require structure such as initiating patient recalls, applying specific codes/descriptors and billing requirements. This structure is being applied to one the most unstructured society in the world where time has no meaning, there are no specific appointment times, just the hours the clinics are open. Even then the clinic staff are often approached late at night to provided services outside of clinic hours. According to one health worker interviewed *"proactive health care is difficult due to cultural and lifestyle issues in the indigenous communities"*. These indigenous cultural issues are impacted by the inability of the Ng Health Service to keep long term staff. The CEO of the health service observed that *"the remoteness, isolation and fact that they are dry communities make it difficult to attract and keep staff. The clients of the health service are unable to build up trust and repour with the*

staff due to the constant turnover. Like wise the staff do not build up a long-term picture of a client's needs".

There were significant inhibitors around the technical issues which stemmed from the remoteness of the Ngaanyatjarra Lands and the lack of software available suited to the extreme conditions. According to Chief Information Officer (CIO) *"the remoteness of the sites makes it difficult to solve problems over the phone. When all else fails a site visit is required and this can take days and be very expensive due to the enormous distances involved travelling from Alice Springs out to say Warburton, a 2,000km round trip. So help is either virtual or days away"*. In response to this difficulty the CIO said that they had *"to set up the systems in very basic level so the things can just be replaced 'we have dumbed down the bush' and kept the complexity in Alice Springs"*.

The main administrative issues came from the lack of protocols for the accessing of electronic health records from other services. The Ngaanyatjarra people often move outside of their lands and then come under the health system of the Northern Territory or South Australia. Under current legislation records can not be shared due to confidentiality laws. The lack of information exchange often lead to *"children being immunised twice as the mother could not remember and the child's records were held by another health service"* child health nurse.

The final inhibitors centred on the lack of technical expertise of the health care workers due to the low level of IT adoption in the Australian health system and due to the clinic staff tending to be *"middle age women which tends to be the demographic that are more likely to work out in the remote regions"* according to the CIO.

Table 2: Drivers, Inhibitors and Risks of Electronic Health Records

Drivers	Inhibitors/Risks
Health Care Benefits	Technical
<ul style="list-style-type: none"> The ability to track patients as they move for one community to another 	<ul style="list-style-type: none"> Lack of ICT infrastructure with some of the remote communities relying on satellite links rather than broadband
<ul style="list-style-type: none"> Instant access to record from other clinics so that if one person is seen in one community then they turn up at another clinic the staff are able check on what treatment they have received 	<ul style="list-style-type: none"> Cost of system implementation and maintenance due to the remoteness of the communities. IT staff have to drive for at least a day to reach the closest of the communities. Flying is the only other means of access and the cost prohibitive.
<ul style="list-style-type: none"> Recalls for the patient to attend the clinic for services such as immunisation follow-up check ups or for specific specialists when they come to the clinic 	<ul style="list-style-type: none"> Frequent power outages and a lack of back up power mean the clinicians cannot rely on the system 24/7. If the power is out in one clinic the staff have to ring a clinic in another community for patient information.
<ul style="list-style-type: none"> Print up recall lists and communicate to the community who should turn up. 	<ul style="list-style-type: none"> Availability of suitable web based software and robust hardware at the time of implementation
<ul style="list-style-type: none"> Improved health outcomes 	

Table 2: Drivers, Inhibitors and Risks of Electronic Health Records (Cont.)

Drivers	Inhibitors/Risks
Administrative	Administrative
<ul style="list-style-type: none"> The provision of a significant grant for the Federal Government was provided for the health service establish the system 	<ul style="list-style-type: none"> Lack of protocols for access to other electronic health records outside to the Ng Health Service. Patients often move to communities outside of the Lands
<ul style="list-style-type: none"> Keep in line with the ad hoc adoption of electronic health records by health services in other indigenous communities in central Australia 	<ul style="list-style-type: none"> Access to immunisation records across the three states to reduce over inoculation of patients. Interface with external systems required
<ul style="list-style-type: none"> The quality and uniformity of record keeping in remote clinics can be maintained through online review by the central administration in Alice Springs 	<ul style="list-style-type: none"> A way of being able to share data with services outside Ng Health without allowing total access to all the files in the database.
<ul style="list-style-type: none"> Electronic records means that the health service can scrutinize all health records held across the communities thus giving a higher level of accountability for staff and quality of performance measurement 	<ul style="list-style-type: none"> Some way to insert a date stamp when working with critical patients so that the Royal Flying Doctors Service can see the development of the patient's condition over time
<ul style="list-style-type: none"> Generation of statistical reports that are created through the system for reporting purposes for funding agencies 	
	Human Resource Issues
	<ul style="list-style-type: none"> Lack of previous experience with IT and health IT programs
	<ul style="list-style-type: none"> Lack of ICT knowledge among staff
	<ul style="list-style-type: none"> Transient nature of staff due to isolation. The time taken to learn the system and the transient nature of the staff means that often the benefits of the system are lost.

Staff turnover was considered to be an issue as some staff experienced a culture shock and geographical dislocation if they were from outside of the region. The training of new staff on the system was a problem as few people had worked on a similar system and orientation was conducted over the phone and included team viewer software. According to the CIO *staff training includes orientation over the phone, the use of team viewer for training...one of the problems is that long term staff do not stay*” longer than their 3 month contract.

Electronic health records used in Australia are mainly stand alone systems such as Medical Director which is used in GP practices. Networked records such as those used by Ng Health have not been widely adopted in Australia. Other problems related to system use included additional functionality to deal with epidemiological work that interfaces with other systems outside of the region. For some users the loss of eye contact with the patient while working on the computer was also an issue.

Risks include issues of systems reliability because of the reliance on Telstra (telecommunications company). From a risk perspective the cost of risk management is beyond the funding of the programme, as one manager said: *“If you analysed the risk you would not have turned it on”*.

3 Discussion

The main benefits of e-commerce centre on improved delivery of products and services. Research found significant benefits in the delivery of health care using electronic health records for the very mobile indigenous population of the Ngaanyatjarra Lands. The benefits cited by the respondents in relation to reporting requirements and administration differ from e-commerce, as the Ng Health service is regulated and funded by government agencies. There were some similarities between e-commerce and e-health in the areas of service logistics, efficiencies and process improvements as the electronic health records allowed for more individualised and proactive health for the Ngaanyatjarra people.

By comparison, the inhibitors for e-commerce and the adoption of electronic health records were similar in the technical and human resources areas. The Ng health service struggled with a lack of systems compatibility, the costs of acquiring and maintaining an e-health capability and there were concerns about security and control of the information held on the system.

In relation to human resources the following e-commerce barriers were present in the Ng health case study – a lack of knowledge of the internet, lack of skills/ technology /training in-house, resistance from employees based on fear of technology, inertia, lack of faith, and poor availability of external skills. The area of difference from e-commerce adoption was in the administrative area as this is directly impacted by government regulation. The variation in procedures between the health providers in the three states through which the Ngaanyatjarra people travel led to an inconsistency in treatment.

E-health adoption issues previously identified in the literature such as the diversity of the stakeholders and service providers and the cost of e-health provision were present in the case study. In relation to security and privacy issues Ng health experienced difficulty due the lack of access to information held on the databases of adjacent health services. Surprisingly the clients themselves did not express any concerns about the confidentiality of their medical records. Generally, the clients were disinterested in their electronic records and it was only the occasional young person who showed any interest.

4 Limitations and further research

The case study was of an investigative nature as NG Health is one of the few electronic health networks in Australia at this present time. There are other regional networks in Australia which could be used for further research and comparison. The adoption of electronic health records by Ng Health was not driven directly by government but as means of providing improved health care to their clients. The success of the Ng Health Service is due to the foresight of the CEO and the IT staff who, against enormous odds, successfully implemented an electronic health records system in one of the most inhospitable environments possible.

Further investigation could be undertaken into the processes used to overcome some of the adoption barriers encountered in the implementation of electronic health records by Ng health as these may provide insight for the Australian government's agenda on the implementation of e-health. There may also be skills, systems, knowledge and solutions that could be of use to organisations seeking to successfully implement e-health systems in remote regions elsewhere in Australia and overseas.

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